CORNELL
EXTENSION
BULLETIN
1001

KILLING UNDESIRABLE WOODY PLANTS WITH CHEMICALS . . . . .

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Figure 1. Untreated stumps of thornapple starting to sprout. Soon sprouts will completely cover the old stumps.

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The removal of undesirable shrubs and trees is not an easy task. Frequently, cutting, bulldozing, or pulling them out are the most effective methods. Certainly, only such mechanical operations will remove trees and brush immediately. These methods, however, are often expensive, and sometimes the land to be cleared is too steep or too rough for mechanical equipment. Moreover, sheering off the part above the ground does not always complete the job, since the stump or roots may soon send up new sprouts. Like a mythical monster, when one head is cut off, new ones appear to take its place (figure 1).

Figure 2. Thornapple killed by basal stem spray of 2,4,5-T in early March.

Where mechanical means are too costly or impractical for other reasons, chemicals that kill brush may solve the problem (figure 2). Proper selection and application of these chemicals prevent or reduce sprouting. However, brush killers are not a vanishing cream that will make your woody weeds disappear overnight. Rather, the dead tree or bush will stand as a monument to your success until it finally decays or until you get tired of looking at it and knock it down. Of course, for many purposes, such as killing brush in pastures, hedgerows, and Christmas tree plantations, or eliminating unmerchantable trees from the woodlot, appearance doesn't matter as long as the plants are dead.

With the exception of the very dangerous sodium arsenite, the chemicals discussed in this bulletin are not ordinarily poisonous to animals. Livestock should be kept away from dying cherry trees, for the wilting leaves of cherry can cause illness and perhaps death.

Selective Chemical Group

The selective hormone-type chemicals, 2,4,5-T and 2,4-D, or a mixture of the two, are particularly useful compounds because they can be applied in several different ways. If the proper treatment is selected, it will do a good job on most broad-leaved shrubs and trees. Because these compounds are less effective on conifers, they may sometimes be used selectively in areas where both conifers and broad-leaved plants grow. Properly applied, the chemicals reduce sprouting. Used with ordinary precautions, they are not poisonous to animals. They will, however, kill vegetation, desirable and undesirable, and unless you are careful to prevent the chemicals from coming in contact with valuable plants, you may kill some you want to preserve. A few wise precautions are: (1) Use the chemicals on days of little or no air movement; (2) Use low pressures in

spraying; (3) Keep the container sealed when not in use; (4) Use a separate sprayer for weed and brush killing, and do not use it for other purposes.

If you must use a sprayer for other purposes which has previously held 2,4-D or 2,4,5-T, clean it thoroughly. To clean the sprayer, first wash out all the parts with kerosene or fuel oil, then fill the sprayer, wand, and hose with a solution of 1 part of household ammonia per 100 parts of hot water. Let this solution remain in the sprayer for at least 24 hours. Rinse the equipment several times with clean water and test it on some susceptible plant such as tomato or bean.

2,4,5-T is manufactured by several different chemical companies, and it is sold under a variety of trade names. It is important to read the fine print on the label to find just what you are buying. Be sure to find the number of pounds acid equivalent, for this tells how potent the chemical is. For example, 2,4,5-T with 4 pounds acid equivalent at $12.00 a gallon is a better buy than 2,4,5-T with 2 pounds acid equivalent at $8.00 a gallon. The low volatile ester form of 2,4,5-T should be used for woody plants. A mixture of 2,4,5-T and 2,4-D is similarly distributed and is somewhat cheaper than 2,4,5-T alone. Plants, such as willow, poison ivy, poplar, alder, and black locust, are apparently quite susceptible to the mixture, and using straight 2,4,5-T simply runs up the cost. In general, use the mixture for foliage treatment and use 2,4,5-T for other methods and for resistant species, such as beech. 2,4-D alone is much cheaper still, but killing results are often correspondingly lower. Consult your nearest forester or agricultural agent for advice on which compound to use for the particular species you wish to control.

Careful and thorough application is important. Poor results are more often due to poor application than to the chemical. Follow the directions given by the manufacturer, for they are usually somewhat more than enough to do the job. There is no point in mixing a stronger spray solution than is recommended, for you will not increase your percentage kill in proportion. Use plenty of spray; high dosages at ordinary strength are better than low dosages of triple strength, both for getting better top-kill and for reducing sprouting. Mix solutions thoroughly.

Do not expect immediate, spectacular dying of treated plants. The action of these chemical compounds is comparatively slow. Trees, especially, take one to three or more years to die, since the treatment often kills by means of a chemical girdle. Generally, less sprouting occurs when the plants die slowly, but one application seldom eliminates this problem. It is especially difficult to control sprouting from roots in species such as pin cherry, thornapple, sumac, and poplar, since the chemical seldom goes far into the roots. In the case of these root sprouts, several yearly treatments may be necessary until the root-suckering power of the plant is exhausted. Seeding to grass or planting to fast-growing trees

helps to crowd out root sprouts. Delay in respraying may be costly since 2-year-old sprouts are much more vigorous than 1-year-olds. Therefore, be prepared to spray more than once, and be prepared to use more than one method of application. Better to learn to do a small area right than to treat large acreages and fail through inexperience.

A newer chemical, amino triazole, or ATA, is apparently suitable as a foliage spray only. It can be used advantageously on white ash, poison ivy, and poison oak, but is less effective than 2,4,5-T on other pests such as thornapple and aspen. It cannot be used during the dormant season as a basal spray, however. Killing action may take 1 to 3 years, with the leaves of sprayed plants turning white before dying.

Application

(1) *Foliage spray.* Foliage spray should be applied to brush not over 5-7 feet tall while the woody plant is still growing vigorously, June and July (figure 3). Early spring and early fall treatments are generally unsatisfactory. Mix with water according to the manufacturer's directions (usually 1 gallon to 100-200 of water). Completely wet all foliage of the plant. Addition of a coloring agent to the spray will assist you in determining the extent of your coverage. Foliage spraying is less effective than other methods in reducing sprouting from the root collar. It holds brush in check, but seldom kills completely. Substitution of kerosene or fuel oil for 10 per cent of the water sometimes makes more effective kill. For least damage to conifers planted nearby, oil should be omitted and spraying delayed until early August. In order to make a proper emulsion when oil is added, the chemical and oil should first be mixed together. Then add the water slowly while stirring the mixture constantly.

(2) *Stem spray to intact bark (Basal spray).* Small hardwood trees (under 5 inches diameter) and most other broadleaved woody plants have proved susceptible to 2,4,5-T in an oil mixture, applied to the basal part of the stem. The spray should be applied from groundline up to a height of 6-10 inches, all around the stem. Apply enough material so that it actually runs down the trunk, and be sure to wet the groundline area and root collar thoroughly. This practically eliminates sprouting from the root collar, but may have little effect on sprouting from roots (figure 4). Many plants can be sprayed at any time of the year, except when snow or ice covers the root collar. Poor results often follow spring treatment made just before leafing. For some plants, certain seasons are better. For example, thornapple is best treated from November through March (figure 2). However, root suckering in some plants, notably aspen, is best controlled when spraying is done in middle or late summer after full leaf development. Ashes, basswood and birches are among the most resistant species to this treatment. Use low pressure sprayers or a "gravity"

Figure 3. Foliage spray of unwanted aspen at height of the growing season.

Figure 4. Root sprouts developed after thornapple tops were killed with a winter basal stem spray. Follow-up sprays will be necessary to rid an area of thornapple.

sprayer. Gravity sprayers cut down spatter and loss of spray, but may take a little longer. The use of low pressures, the very nature of the technique, and the fact that it can be used when desirable annuals are not above ground, all mean reduced "drift" hazard. The carrier used may be kerosene or fuel oil. For the amount to use, follow the directions on the label. (Generally 1 gallon to 20-50 gallons of diluent).

(3) *Stem injections.* Large trees (over 4-5 inches in diameter) are often more vigorous, have thicker bark, and need relatively more poison than small trees for good kill. While most large hardwoods can be killed if enough poison is applied on the bark, it is more economical to use less chemical and inject it into the stem (figure 5). A frill of axe cuts around the tree serves well for this purpose. A solution of the compounds may then be squirted in with an oil can. The cuts must overlap so that *every bit of the tree circumference will receive poison* (figure 6). Use the same carriers and mixture recommended for stem sprays, and apply at any season of the year, except when excessive sap flow from the tree will flush the chemical out of the cuts. For this method, very little chemical is required, and good kill depends primarily on cutting through the bark of the entire tree circumference. Trees of all sizes can be killed, and the method is especially recommended for white ash, basswood, and birches, which resist stem sprays. On

Figure 5. A large beech tree is dead four years after a large dose (stem spray) of 2,4,5-T in the winter. Such large trees are more cheaply killed by injecting the chemical into an axe frill.

Figure 6. Beech tree remains alive when axe frill was not carefully made all around the tree. Note strip of live wood where no cut was made.

most species the frill can also be made with mechanical girdlers. To reduce sprouting, summer and fall treatments near the root collar work best for many species.

In thinning young pine plantations, squirting the undiluted amine form of 2,4-D into axe cuts, leaving no more than 2-3 inches between gashes, is quite effective.

(4) *After cutting spray.* If your problem woody plants are to be removed by cutting, an immediate fol-

Figure 7. A reciprocating-type power saw is one of the better tools for cutting multiple stems, which are commonly found in thornapple.

low-up spray of the cut stubs or stumps will largely prevent sprouting from the root collar. The spraying should be done as soon as possible after cutting. Wet the cut surface, the sides of the stump and the exposed roots thoroughly, using the same spray solution as for stem sprays. Stumps should be cut as low as possible to help prevent sprouting. Chain saws or power brush saws aid in the difficult job of cutting woody plants (figures 7, 8).

Figure 8. Follow cutting with chemical spray to prevent sprouting from the stump.

Ammonium Sulfamate (Ammate)

The chemical compound ammonium sulfamate is a non-selective tree and brush killer which will kill or injure the tissue of most plants with which it comes in contact. Fast, over-all kills of the above ground parts of woody plants are obtained when this material is applied as a foliage spray or a stem injection. Root killing is uncertain and resprouting may be troublesome as with the selective brush killers. Ammonium sulfamate solutions are non-voltile and non-poisonous. Its disadvantages are its fairly high cost and its corrosive effect on spray equipment. Prolonged contact with ammonium sulfamate may cause minor skin irritation. In addition, it sometimes kills nearby trees by translocation through root grafts. To minimize the build-up of sawyer beetle populations in pine plantations, treat in September or October.

Application

(1) *Foliage spray.* Because it is non-volatile, there is very little danger of damage to desirable plants nearby during foliage application. The spray should be applied after the leaves are fully developed, but while the plant is still growing vigorously. Late summer sprays of ammonium sulfamate, though not as successful as early summer sprays, have given good results. The spray solution is made by mixing 1 pound of the salt with each gallon of water. Remember to rinse out the spray equipment thoroughly immediately after using it. Use of a coloring agent will help determine the adequacy of coverage.

(2) *Stem injections.* Ammonium sulfamate solution may be applied to axe cuts through the bark of large woody plants, completely encircling the stem. The solution should contain 2-4 pounds of the salt per gallon of water. The dry salt may be put in notches which are chopped 3 to 6 inches apart around the base of the tree. One heaping tablespoonful of ammate crystals put into each freshly cut notch will do the job. Though this is more expensive than injecting the solution into the plant, it is more effective and reduces sprouting. For maximum effect on resprouting, chop the notches as low as possible on stem. (Ammate treatment is good for thinning coniferous plantations, since conifers resist 2,4,5-T stem spray). Summer treatments are best, although success has been achieved all year round in the southern United States.

(3) *Stump treatment after cutting.* Fresh cut stumps of trees may be treated with ammonium sulfamate in order to kill the root systems. The dry crystals should be put on the outer sapwood of the stump. If desired, the stumps may be sprayed with the solution of the same strength used in stem injections. Apply any season. 2,4,5-T has generally given better results.

Sodium Arsenite

A stem injection made with sodium arsenite is probably the quickest, cheapest and surest way of killing all woody plants, both conifers and hard-

woods. However, sprouting both from roots and the root collar is a problem. Applications made from August to December have killed the plants effectively and given a minimum of sprouting. Most rapid top-killing takes place following May to August applications. Preliminary encouraging results have been reported from a double-arseniting technique which involves two treatments approximately 10 days apart. The second treatment apparently has some effect in killing the roots and may even kill some existing root suckers. Occasionally other trees have been killed through root grafts. To minimize the build-up of sawyer beetle populations in pine plantations, treat in September or October.

Sodium arsenite is the cheapest of the three chemicals in common use as brush and tree killers. Because it is a *deadly poison* to both animals and humans, it should be handled with proper respect. Wear gloves to protect your hands during application, and carry a small quantity of zinc sulphate solution for washing off any arsenite that is splashed on your skin. At least one brand of commercially available sodium arsenite contains an animal repellent, which should eliminate some of the hazard to deer and stray domestic animals.

While the chemical is available as a powder that may be mixed at home, it is much safer and easier to obtain the liquid sodium arsenite. This solution is currently available at strengths of from 3 to 5 pounds of dry sodium arsenite per gallon. It seems to be quite effective in killing at even a 2 pound strength and therefore may be diluted with water to this level.

Application

(1) *Stem injection.* Make a series of axe cuts around the tree, leaving no more than 3-4 inches between gashes. Fill the cuts with liquid sodium arsenite. A battery-filling syringe or a hydraulic pump oiler is useful in filling the cuts with a minimum of overflow and drip (figure 9). For stems between 2 inches and 12 inches in diameter, the Cornell Tree Killing Tool may be found useful (figure 10). The tool not only makes the incision, but by means of an impact-release valve, places the chemical solution in the cuts. A supply of the chemical is stored in the tube which also serves as a handle. Whichever technique is used, the extra supply of sodium arsenite should be carried in a closed container, or one specially designed to prevent spillage. Wash out equipment with water, since the chemical is mildly corrosive.

The hazardous and messy handling of liquid sodium arsenite may be largely avoided by using paper tabs which have been previously saturated with the chemical. Called "Swain-tabs" after Professor L. C. Swain, they will bring about the death of trees when inserted under the bark at 3-5 inch intervals. They are most easily pushed under the bark during the sap-peeling season (May-July), and are most useful with small or thin-barked trees, especially conifers. Poor results

Figure 9. Sodium arsenite may be applied to axe cuts by a pump oiler in the chemical thinning of pine plantations.

are generally obtained with hardwoods over 12" diameter. Wear gloves when handling these tabs.

(2) *Other methods of application.* The use of sodium arsenite is not recommended in other methods of treatment, such as foliage spray, stem spray, or stump spray, because of the dangers involved and the uncertain results.

(3) *Chemi-peeling.* Sodium arsenite is also used in the chemical peeling of trees for the production of pulpwood, poles, fence posts and bark-free fireplace wood. If applied properly during the sap-peeling season (May-July) the bark will again loosen, either during the fall of the same year or in the following spring. In the case of beech, the bark will fall off the standing tree. Information on this subject is given in Mimeo Leaflet No. 6 of the Department of Conservation, New York State College of Agriculture.

Figure 10. The Cornell Tree Killing Tool used to inject sodium arsenite into a young aspen.

A publication of the
New York State College of Agriculture,
a unit of the State University of New York,
at Cornell University,
Ithaca, New York

January 1958

Cooperative Extension Service, New York State College of Agriculture at Cornell University and the U. S. Department of Agriculture cooperating. In furtherance of Acts of Congress May 8, June 30, 1914. M. C. Bond, Director of Extension, Ithaca, New York.